IJAE
Vol. 116, n. 1 (Supplement): 132, 2011
ITALIAN JOURNAL OF ANATOMY AND EMBRYOLOGY

Electromagnetic fields (EMFs) and adenosine receptors modulate prostaglandin E_2 and cytokine production in human osteoarthritic synovial fibroblasts

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Objective. Synovial fibroblasts (SFs) contribute to the development of osteoarthritis (OA) by the secretion of a wide range of pro-inflammatory mediators, including cytokines and lipid mediators of inflammation (1). Previous studies show that electromagnetic fields (EMFs) may represent a potential therapeutical approach to limit cartilage degradation and to control inflammation associated to OA, and that they may act through the adenosine pathway (2). On this basis the aim of this study was to investigate if EMFs might modulate inflammatory activities of human SFs derived from OA patients (OASFs) and the possible involvement of adenosine receptors (ARs) in mediating EMF effects.

Design. SFs obtained from OA patients, undergoing total hip joint replacement surgery, were exposed to EMFs (1.5 mT; 75 Hz) for 24 hours. In control and EMF-exposed cells, ARs were evaluated by western blotting, quantitative real-time RT-PCR and saturation binding experiments and cAMP levels were measured by a specific assay. In the absence and in the presence of interleukin-1β (IL-1β), used as a pro-inflammatory stimulus, prostaglandin E_2 (PGE_2), cytokine and matrix degrading enzyme production was evaluated in OASFs exposed to EMFs and treated with selective adenosine receptor agonists and antagonists.

Results. EMF exposure induced a selective increase in A_{2A} and A_3 ARs. These increases were associated to changes in cAMP levels, indicating that ARs were functionally active in EMF-exposed cells. In IL-1β-treated OASFs, functional data obtained in the presence of A_{2A} and A_3 adenosine agonists and antagonists showed that EMFs inhibit the release of (PGE_2) and of the proinflammatory cytokines interleukin-6 (IL-6) and interleukin-8 (IL-8), whilst stimulate the release of interleukin-10 (IL-10), an antinflammatory cytokine. Further, results show that these effects appear to be mediated by the EMF-induced upregulation of A_{2A} and A_3 ARs. No effects of EMFs or ARs have been observed on matrix degrading enzymes production.

Conclusions: EMFs display anti-inflammatory effects in human OASFs and these EMF-induced .ffects are in part mediated by the adenosine pathway, specifically by the A_{2A} and A_3 ARs activation. Taken together, these results suggest that SFs could represent potential therapeutic targets cells for EMF treatment and open new clinical perspectives to the control of inflammation associated to joint diseases.

1. Martel-Pelletier J *et al.* Eklem Hastalik Cerrahisi. 2010; 21(1):2-14.
2. De Mattei M *et al.* Osteoarthritis Cartilage. 2009; 17(2):252-262.

Keywords: human synovial fibroblasts, osteoarthritis, electromagnetic fields, adenosine receptors, inflammation